Print Spooling Subsystem in AIX 4.1

By Eddie Ho and Ravi Mandava

This article describes the Print Spooling Subsystem in AIX 4.1, which provides many improvements over AIX 3.2. It simplifies the overall task of system management—particularly queue management—by providing better job control and improved usability.

In a typical client/server environment, servers are dedicated to a special purpose, such as databases, applications, communications, or printing. Each server must be scalable and flexible in order to meet constantly changing user requirements. The AIX 4.1 Print Spooling Subsystem has been reengineered to meet this need. Enhancements include the following:

- Overall user interface improvements
  - Restructuring all System Management Interface Tool (SMIT) panels and the navigation flow
  - Integrating with Visual System Management (VSM) for the desktop user
- Better job control capability
  - Holding and releasing a job
  - Moving a job to a different queue
  - Validating job options before spooling
- Standardized support for OEM printer attachment
- Printer colon file enhancements
- Streams-based serial-printer-discipline support

Details of these enhancements are described in *AIX Version 4.1 System Management Guide: Operating System and Devices* (SC23-2525) and *AIX Version 4.1 General Programming Concepts: Writing Programs* (SC23-2533).

Printing Overview

The AIX 4.1Print Spooling Subsystem is a robust platform to meet the needs of client/server applications in a distributed commercial environment. The subsystem is flexible enough to scale from desktop ASCII terminals with a printer to high-end systems with massive printing needs. The subsystem, which can be used for both printing and plotting, supports the following types of devices:

- ASCII terminal with an attached printer (transparent printing)
- IBM Xstation with a printer attached to its serial or parallel port
- Printer attached to the 7318 (P10) Network Communication Server's parallel port
- Printers attached to a RISC System/6000 using the built-in serial ports or the multiport adapter with 8, 16, or 128 ports
- LAN-based direct printers, such as the HP JetDirect® or IBM 4033 LAN Connection
- Remote printers accessed by routing a job from a local to a remote queue, with the remote system being AIX, System V Interface Definition (SVID), Berkeley Software Distribution (BSD), or any host that supports the Line Printer Daemon (LPD) protocol

Figure 1 summarizes the attachment types in a workgroup environment.

The printing subsystem can support printers with multiple data streams and printers with a country/language locale such as single byte, Extended UNIX Code (EUC), or Unicode. It can also support a range of speeds from personal printing to high-speed printing in a warehouse environment. Supported printer data streams include the following:

- PostScript®
- HP Printer Control Language (PCL)
- Graphics Language (GL) for plotters

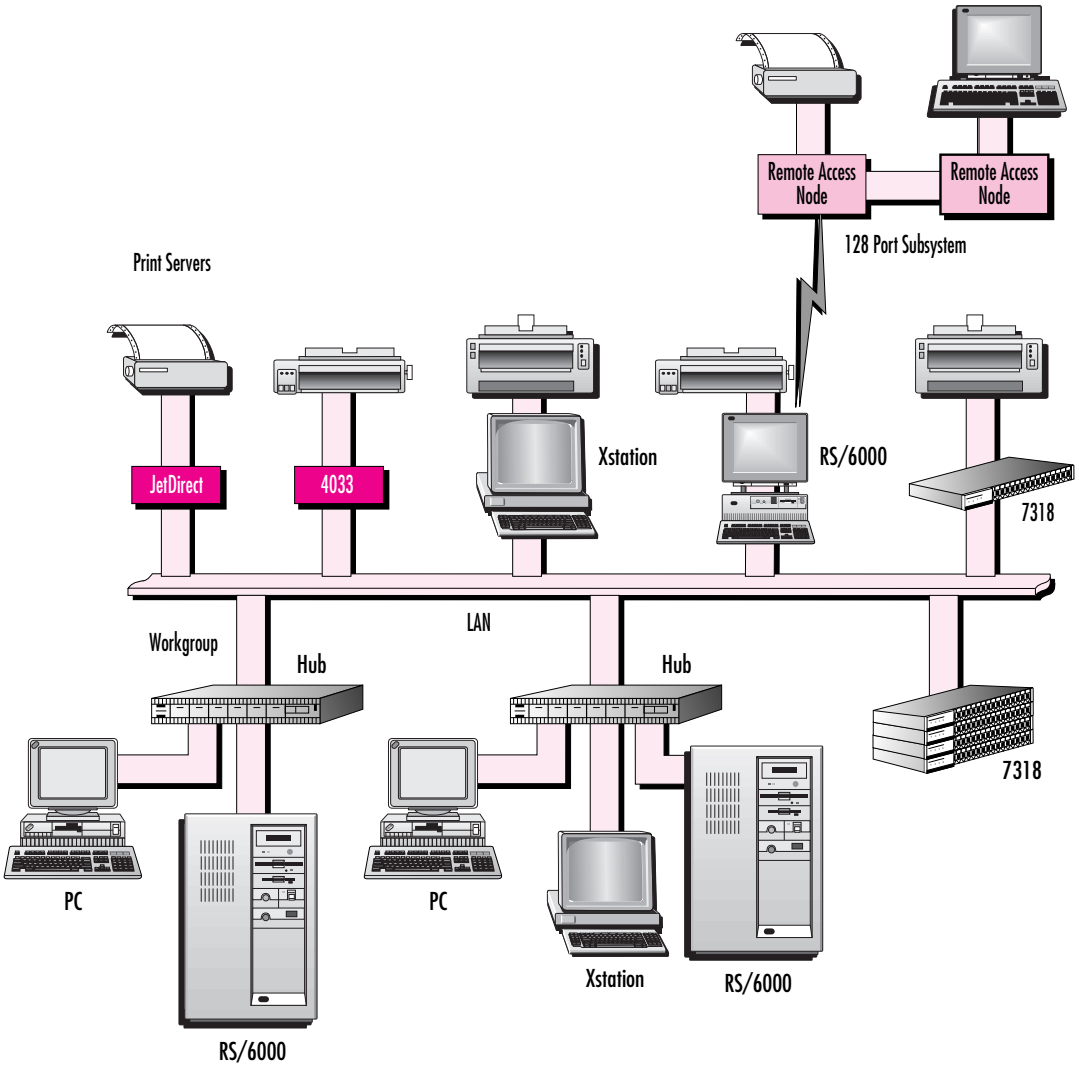

Figure 1. Print server in a workgroup environment

- ASCII

The many print options provide the flexibility to meet most business printing requirements. Options include the following:

- Paper-size and page-layout selection
- Print quality, typestyle, and pitch selection
- Page orientation
- Simplex/duplex printing
- Paper-tray selection
- Header/trailer page
- User-configurable filter for output-data customization
- Code-page selection
- Double-wide and double-high printing

Spooling Subsystem Structure

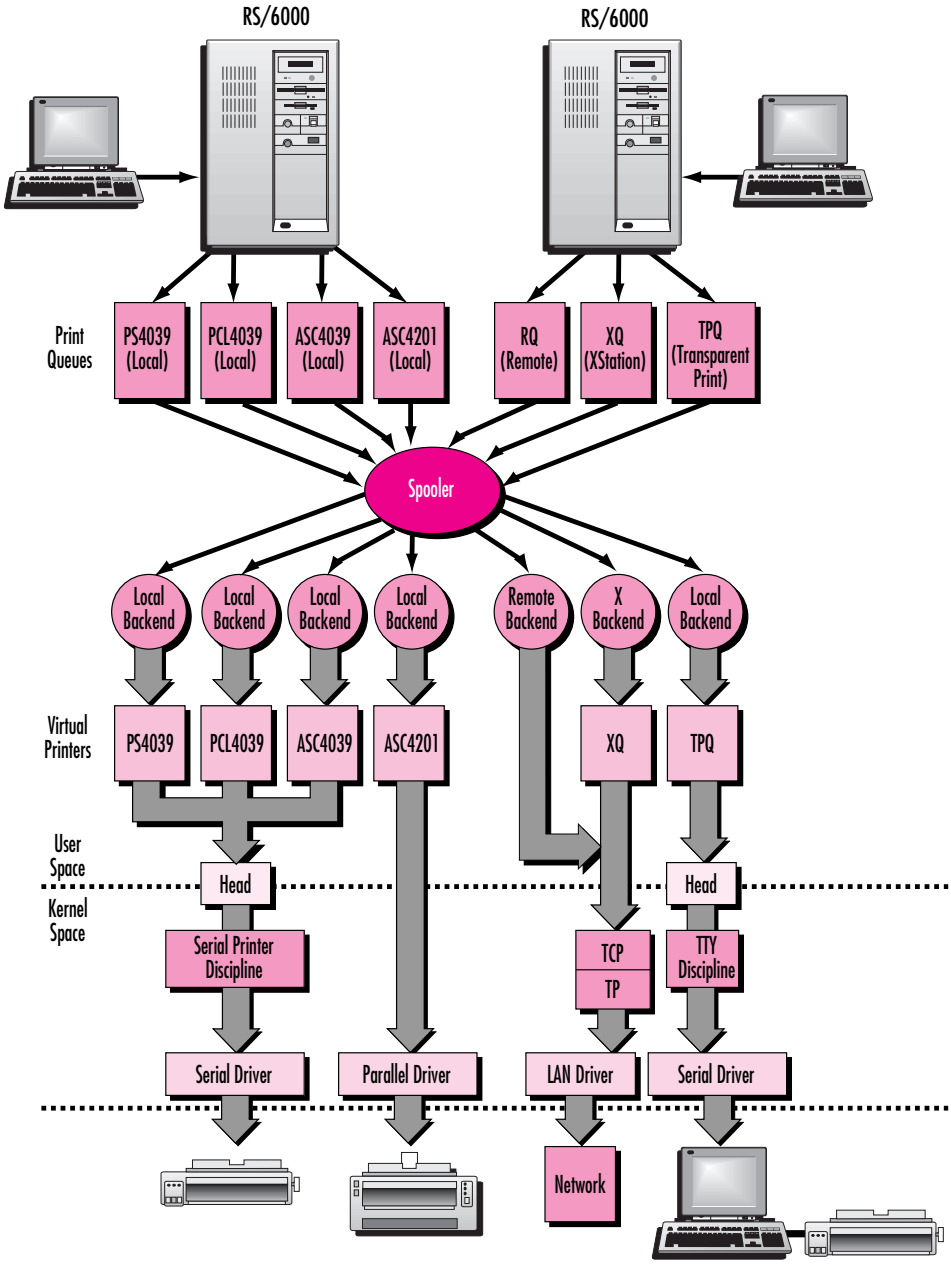

Figure 2. Spooling subsystem structure

Subsystem Infrastructure

AIX 4.1 Print Spooling Subsystem provides the flexibility required in today's printing environment, in which printers often have multiple personalities that allow them to emulate a wide range of other printers. There are two important views of the subsystem: logical view of how printers, virtual printers, and queues interact with each other, and data flow of the file being processed by the subsystem.

Print Spooling SMIT Panels

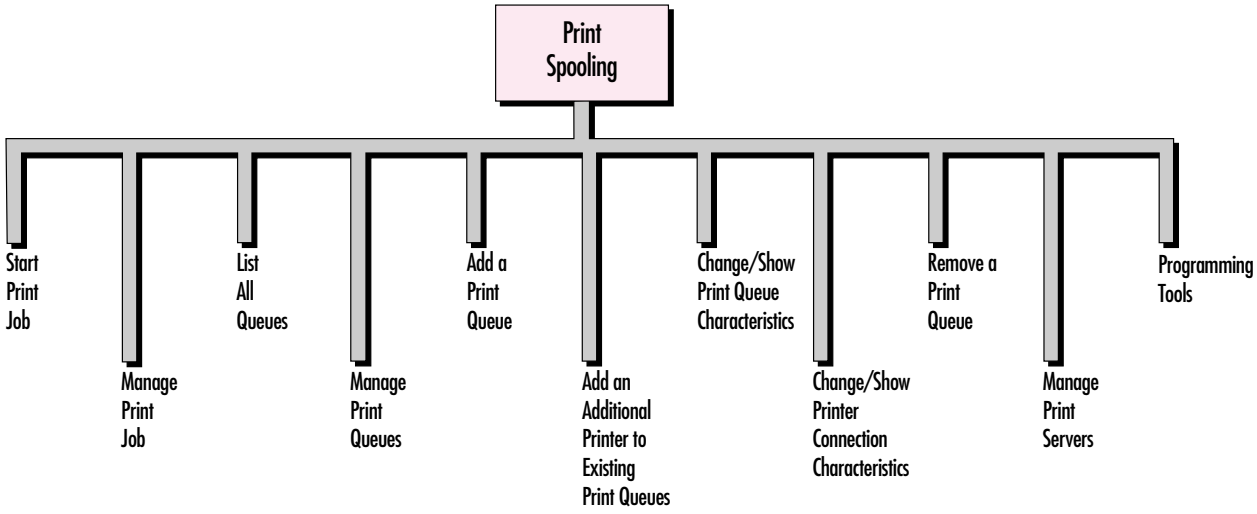

Figure 3. Print spooling SMIT panels

For the administrator, there are three major components in this subsystem:

- **Printers**: Actual devices on which output is printed
- **Virtual printers**: Components that translate the job data into specified data streams that can be supported by the printer
- **Print queues**: Queues that handle print requests

Figure 2 shows the various queues and the data path when users submit jobs to a print queue.

User-Interface Improvements

Many improvements have been made based on experience and customer feedback from AIX 3.2. With AIX 3.2, users had difficulties in configuring and changing printers and the associated queues. This difficulty has been alleviated in AIX 4.1 with the following improvements:

- Configuration is provided as part of the graphical VSM. The VSM tool allows users to create print queues and devices by using the familiar drag-and-drop interface.
- The print-queue and device configuration procedure is simplified. The entire internal infrastructure of a queue and a device are created in a single path based on the type of attachment. This can eliminate the need for the system administrator to remember the sequence of operations.
- The interface for job submission is improved. The SMIT interface shows all feature options that are unique to a model. In AIX 3.2, only generic flags are provided in SMIT, and print-formatting options that are unique to a printer model can be specified only from the command line. This requires you to deal with two user interfaces and to have a full understanding of the printer capabilities.
- The concept of virtual printer and queue device is not externalized to the user, who only has to create and administer print queues. The underlying objects are managed automatically.
- A consistent SMIT interface is provided throughout all panels, eliminating use of the curses interface in some panels.
- For remote queue characteristics, users have options provided for viewing and changing queue characteristics during job submission.

Figure 3 shows the hierarchy of the main panel.

Job Control Enhancements

The following improvements give the administrator better control over each job in a loaded environment to alleviate downtime during printer problems and to give better feedback to the job submitter.

Hold and Release

Job holding and releasing is useful for managing printing throughput in a congested environment. For example, a large print job can be held and printed during off hours. In AIX 4.1, each job can be held (by the job submitter or the system administrator) when submitted or queued, but cannot be held while being printed.

Move a Job to a Different Queue

During printer outage, inactive jobs can be moved to a different print queue using a different printer, which can improve availability. This can be done by the job submitter or the system administrator.

Job Option Validation

Job option validation is provided during submission. This is useful in detecting user errors, such as invalid flags and values, and allows you to troubleshoot the problems quickly. In AIX 3.2, job submission errors are not detected until the job is being sent to a printer, which causes delays.

Non-IBM Printer Support

An ease-of-use interface supports the attachment of non-IBM printers, such as the HP JetDirect. In AIX 3.2, the cumbersome `mkvirprt` command incorporates non-IBM configurations. In AIX 4.1, the SMIT interface is recommended and incorporated through *attachment files*. Attachment files contain links to the manufacturer-provided SMIT screens from the print spooling panels.

Printer Colon File Enhancements

The *printer colon file* is a device-specific file that contains the unique printer-control sequences for a particular model. There is one colon file for each type of data stream that a printer supports. Enhancements such as the following are added to improve usability.

- Support `ksh` instead of `bsh` while executing pipelines, filters, and commands. This allows AIX to conform with the default shell standard.
- Accept hexadecimal notation in addition to the current octal notation. The representation is -xXX, where XX is the hexadecimal representation of the character value.
- Generate selection lists in SMIT panels and flag validation. A limits field has been added to the colon files to provide this.
- Execute AIX shell commands with output directed to the specified attributes. The operator syntax is `%`"<command>..."`. This is helpful if the user is not familiar with all the values of an attribute when submitting a print job.
- Provide capability to extract data matching a specific regular expression. This is useful when generating a font selection list while submitting a job. The operator syntax is `%#xx"...@..."` where `xx` is an attribute that contains the source data.

Streams-based Discipline Module

For local printing, there are two key attachments: serial and parallel. The printing behavior is controlled by the discipline module feeding data to the device drivers. This module is used to format print data and manage current printer status. Due to the migration to the Symmetric Multiprocessor (SMP) environment and the new Streams-based TTY subsystem, the serial discipline module is redesigned to use Streams. This allows the flexibility of real-time control and customization of the printing discipline module.

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